Appendix E

LVMS NaI Logging Field Report, Borehole 41-09-39

LVMS OPERATIONAL TEST / BOREHOLE LOGGING OF 41-09-39

Test Date: January 10, 1997

Conducted By: G. L. Lekvold / Logging Engineer
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Introduction: This test consisted of logging borehole 41-09-39 in the SX tank farm, by utilizing the new Leak Verification and Monitoring Borehole Logging System (LVMS)

Purpose of Test: The purpose of this test was twofold:

1. To perform a fully functional, operational test of the LVMS under field conditions, in a deep borehole, with known high rate activity.

2. To collect spectral gamma-ray data from the subsurface area surrounding the borehole throughout the entire depth of the borehole.

Test Conditions: Borehole number 41-09-39 is the second of the two "new" boreholes which were drilled in the south-central portion of SX tank farm. This location was selected by the "Expert Panel". The borehole is located near tank 109 and has a total depth of 130'. Access to the borehole was gained through a special corridor which has been surveyed and declared "clean". Logging was also accomplished within this corridor. Atmospheric conditions during the test were calm and dry, with an ambient temperature of approximately 45 deg. F. The borehole casing is steel, with a diameter of 6". There is a concrete pad around the borehole approximately 3.5" above the top of the casing. The top of the casing, (which was the zero reference) is located at grade.

Test Equipment: The LVMS consists of a diesel pickup truck with an onboard instrumentation system which is described in detail in, "Leak Verification and Monitoring Borehole Logging System Technical Guide, July 18, 1996, Rev 0".

The LVMS system comes equipped with three detachable detector modules: a shielded 1-in by 1.5-in NaI(T1) "small detector", a 1.5-in by 2-in NaI(T1) "medium detector", and a 3-in by 12-in NaI(T1) "large detector". This test was conducted by using the 1-in by 1.5-in "small" detector.

A field verification source, AMERSHAM Ser. No. 115 was used for pre and post verifications. This source is the same type as used on the two Spectral Gamma-ray logging systems currently in use for Vadose Zone logging.

Test Method: During preparation work the day before this test was conducted, the system was operated and a preliminary gain adjustment was made using the Tl-208 peak from Coleman mantles. Immediately prior to commencing logging operations, a pre-verification was performed by

using the field source. The pre-verification was a 1000 second count with the center of the detector located in the center of the source. The pre-verification confirmed that the gain setting was correct. The original plan was to lower the sonde to the bottom of the borehole to determine TD, and then to perform continuous logging to the surface. A centralizer was attached to the sonde. The sonde was lowered into the borehole, and TD was determined to be at 130+feet. Logging was begun at 130.0' with a spatial resolution of .5 ft. Logging speed was set to 5 feet per minute.

Test Results:

It was found to be extremely difficult to set the tool at zero depth prior to the log run. The manufacturer of the winch suggests dialing in a small amount of "up" speed and then putting the winch in the up mode in order to hold it steady, to compensate for drift caused by a heavy sonde. This technique was partially successful, but there appear to be new electrical problems with the winch control, i.e. when the winch is operated from the cab remote and placed in "stop" mode, the winch then operates with an "up" speed of 8.2 ft. Per minute. It is felt that the solution to this problem would be the installation of an electro-mechanical brake on the winch.

In addition to the winch problem described above, initial attempts to lower the sonde into the borehole, revealed the fact that the depth encoder was stopping, or losing the count. Subsequent investigation showed that the encoder signal cable was causing the encoder wheel to bind against the winch cable guides. It was determined that parking of the vehicle is quite critical, in that it must be nearly horizontal. Given some of the very uneven terrain in the tank farms, it will probably be necessary to modify the cable guide assembly to allow for greater freedom of movement in the vertical axis.

Eventually the above problems were resolved and the sonde was lowered to TD. Logging commenced from a depth of 130.0' at 1200 hours. An attempt was made to record count rates in the field notes, but it was somewhat difficult due to the logging speed. Initial total counts on the order of 1000 to 3000 CPS were recorded with Cs counts of 20 to 40 CPS. Count rates steadily increased to extremely high levels around the 80 foot depth. At that depth total count was 190,000+ and Cs counts were 7945 CPS. At approximately 78 ft. An error message of "Run time error '6' overflow" was received and the LVMON program terminated. At that time it was believed that the cause of the problem was either excessively high radionuclide activity, which saturated the system, or that the sonde was suffering the effects of thermal overload. Several attempts were made to resume logging, to no avail. The sonde was then brought to the surface at 12:34 PM. The sonde was warm to the touch but not excessively hot. The tool was then left to cool for approximately 10 minutes.

A new header was then initiated for log run number two, and logging was commenced from the surface to TD at 1:30 PM. Logging proceeded normally with count rates steadily increasing. During the second log run, only "total count" was recorded in the field notes, with no attempt to record any specific radionuclide count rates. At a depth of 79.49', which was reached at 1:53 PM, the same error message of "run time error '6' overflow" was received, at which time logging was

terminated. Immediately prior to termination of the log run, total count rates were of the same magnitude as encountered during the first log run at corresponding depths.

At the conclusion of log run number two the sonde was brought to the surface and a 1000 second post-verification was performed. Examination of the post-verification spectra revealed that the gain had drifted somewhat. It is believed that this drift was probably the result of the increased temperature of the sonde due to the heat in the borehole.

Test Data

All test data including header information, pre- and post-verification spectra, and spectra from log runs one and two were recorded on the "C" hard drive in the laptop computer. The data were then copied onto a floppy diskette and delivered to the appropriate data analysis personnel. Data files are as follows:

Log Run One File Name Root 89ZB1
Pre-verification spectra 89ZB1CAB.CHN
Log Run One Spectra 89ZB1000.CHN through 89ZB1105.CHN
Log Run Two Spectra 89ZB2000.CHN through 89ZB2154.CHN
Post-Verification spectra 89ZB2CAA.CHN

Summary

This test served as a good "shakedown" run of the new LVMS. Not surprisingly, some of the suspected weaknesses in the winch design were indeed found to be rather serious. These problems will prevent use of the system for production logging until corrected. Additionally, it is believed that the data which was acquired, supports the belief that there are high levels of contamination around the 80 foot depth of this borehole.

This report was submitted by_____ on _____

① 1/10/97 FIRST LVMS LOG OF 2ND NEW BOREHOLE

10:35 AM ≈ 45°F AMBIENT

PRECAL START 10:35 1000 SEC COUNT.

AMERSHAM SOURCE #115 L.T. 1000.0 TOTAL COUNT RATE

R.T. 1002.4 228.63

6" CASING - TOP OF CASING AT GRADE

CONCRETE PAD AROUND BOREHOLE ≈ 3½" ABOVE CASING TOP

VERY DIFFICULT TO SET TOOL AT ZERO

ATTEMPTED TO GO DOWNHOLE TO ≈ 1

ENCODER CABLE HUNG UP IN LOGGING CABLE GUIDE,

12:00 AM START LOGGING UP FROM 130.0'

@ 4.9'/MIN

120'

TC 2808

119 Cs137 210.0

116 TC 2832 38.2 Cs

112 TC = 1475 Cs = 32.6

110 TC 1408 32

107 TC = 7063

108 11489 529 Cs

(2)

106

14800 872

105 21944 1290.6

103 55005 4278.0

100 35247 3016.0

95 21720 1128 .7K

93 15330 1613 1.3 .3 Bi

91 38713 2296 9.5 1.8

90 8329 5485 43.8 5.9

86 81489 4800 79.5 15.3

85 168174 13457 691

82 190203 0 0 0

80 179216 745 2.1 0

(3)

78 186004 17374 2462 903 Z

COMPUTER LOCKUP (OVERFLOW

69'

STOP TOOL @ 43.0'

12:34 came to surface tool gate worn

let tool cool for ≈10 min

tried to log top down

get run time error '6' overflow

* "STOP" in col = 8.2 FT/MIN UP

1330 start logging down run # 2

9	12.1	.6		
11	9.7	0	0	.3
13	13.9	0		
15	9.4	.6		
18	12.4	.3		
20	12.9	.3	.3	.3

(4) DEPTH IN FEET

Run # 2

	TOTAL COUNT
24	12.4
26	13.9
28	15.9
30	14.5
32	11.9
34	15.4
36	11.8
38	13.0
40	17.2
~~42~~ 50	17.5
52	22.3
58	71.3
59	136.6
62	3095
63	183419
66	216302
68	184488
72	185328
75	189700
78	134601
76	

79.49' ~~1472~~ Run Tie error '6' overflow

Start Pass cal 1353 L.T. 1000.0

K peak drifted R.T. 1002.5

to left to ≈151 TOT COUNT RATE 246.08

from ≈ 175

(5) 89ZB1 FILE NAME ROOT

89ZB1CAB.CHN

89ZB1000.CHN

89ZB1105.CHN

89ZB2000.CHN

89ZB2154.CHN

89ZB2CAA.CHN